

Hawkeye: Deciphering textural clues remotely

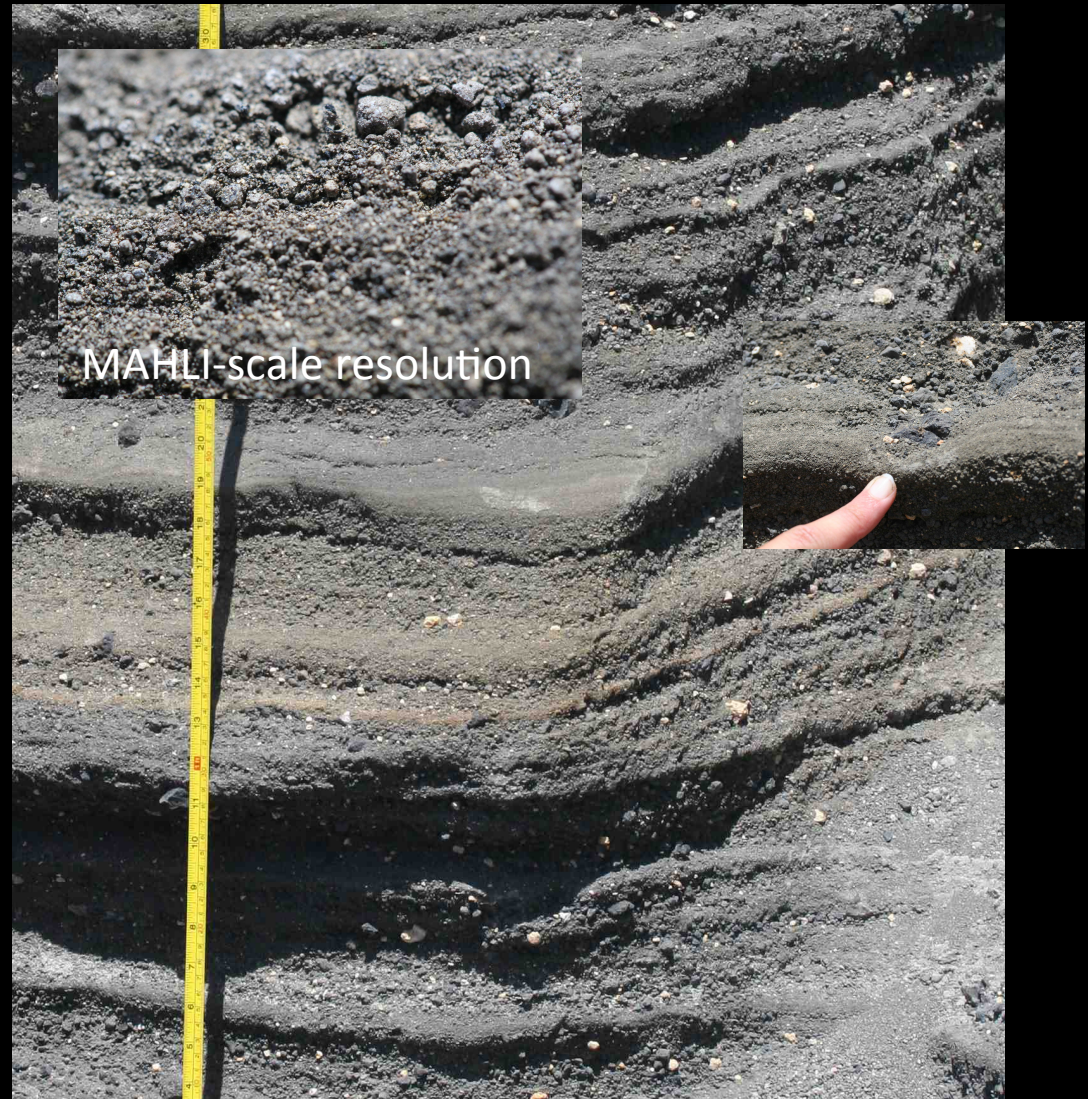
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Summary

- Hawkeye can decipher grain-scale textural clues to geologic or biologic history, from a distance.
- Wide field of view and focus to infinity enable panoramic imaging to place grain-scale observations in regional and local context.
- The broad range of distances over which Hawkeye yields useful images makes it a very cost-effective all-in-one imager that supports science and operations efficiency.

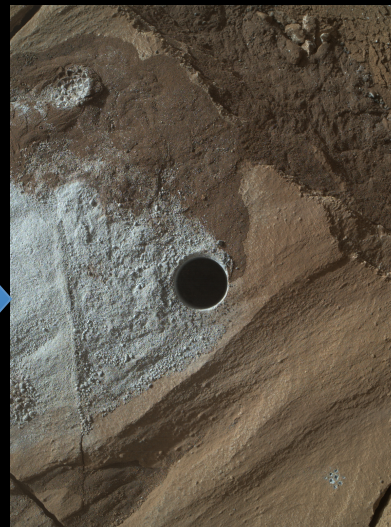
Science background

- Lithologic features involving grains and grain relationships (0.5-10 mm in scale) provide key (sometimes decisive) indicators of rock-forming environments.



What is the need

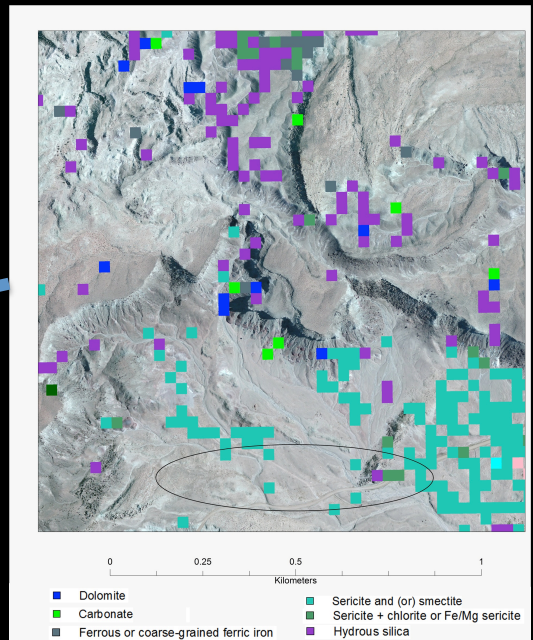
- Resolution at this scale is currently possible, but images are expensive to acquire resource-wise.



What is the need

- Most environments are both laterally and vertically variable at this scale; coverage is key to interpretation.
- Specifically for biosignatures, colonies are predicted to be small and spatially isolated, again necessitating coverage.
- Without sufficient textural data, lithologic clues may be interpreted incorrectly, wasting time and spacecraft resources.

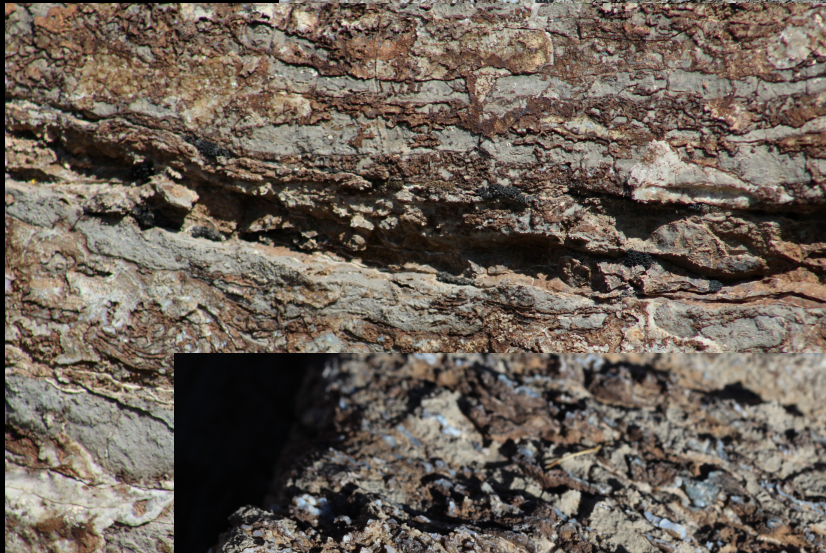
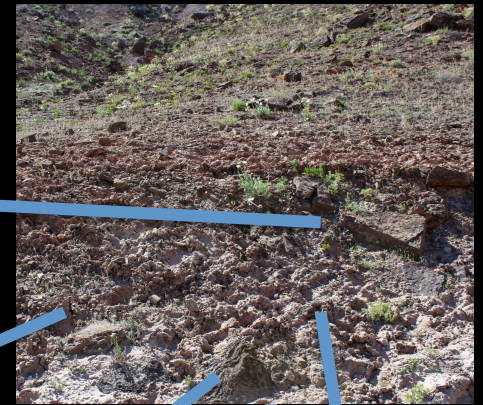
CRISM pixel = amorphous silica, calcite
Surface clasts, possibly from upper layer



- Mastcam/Pancam/SSI-type images to capture morphology
- Both regions are “off-traverse”

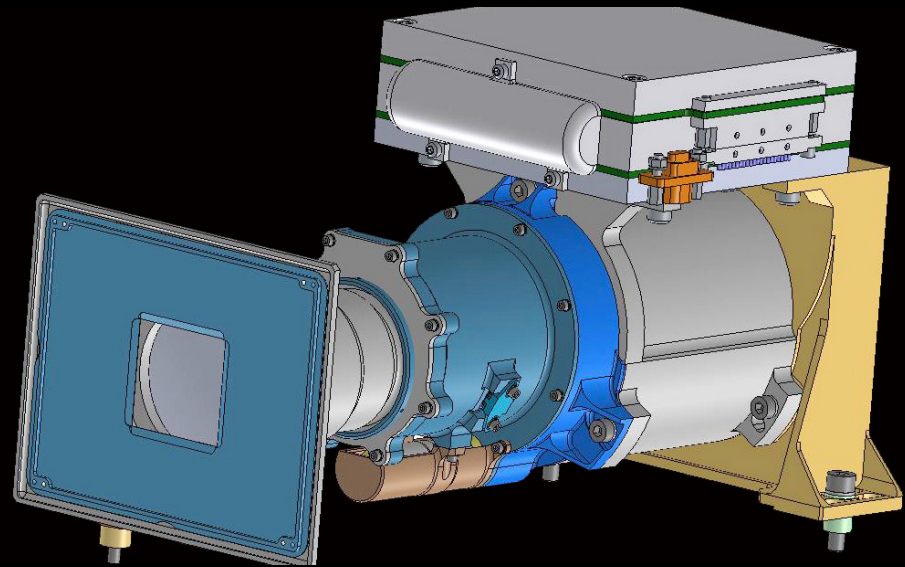


CRISM pixel = amorphous silica, calcite;
Outcrop near unique compositions



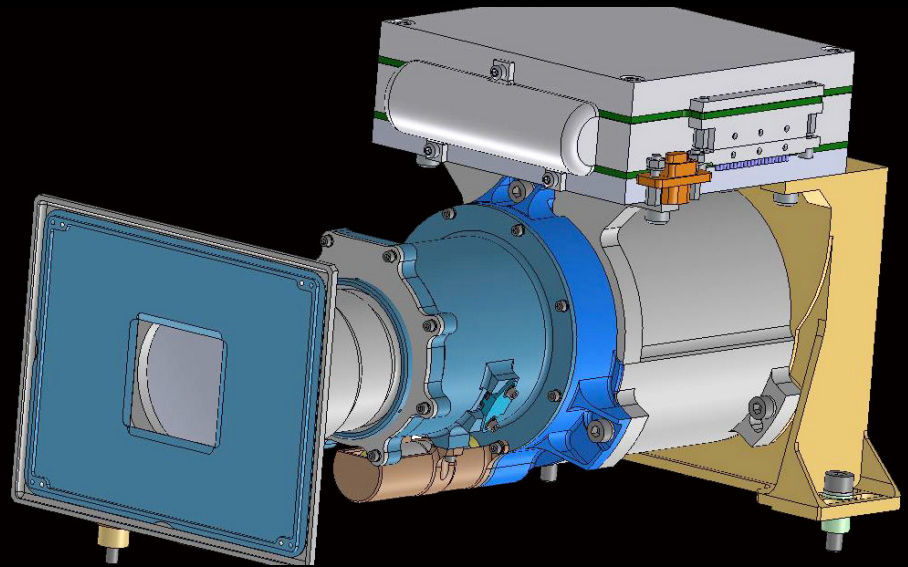
Design

- Focal plane assembly and electronics — build-to-print copy of flight MSL Mastcam
- 1600 x 1200 pixels
- Bayer-pattern RGB
- All-refractive design consisting of one moving focus group and a single front stationary group.
- Focal length 370 mm, focal ratio of f/10, focusable closer than 2 m.

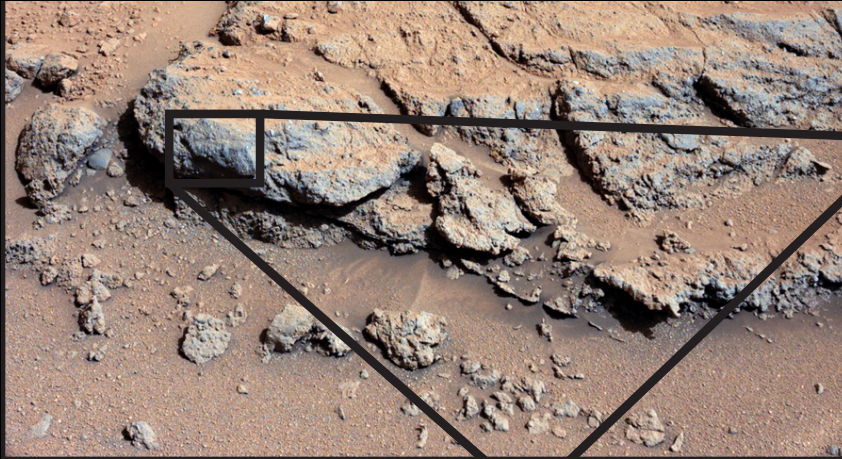


Design

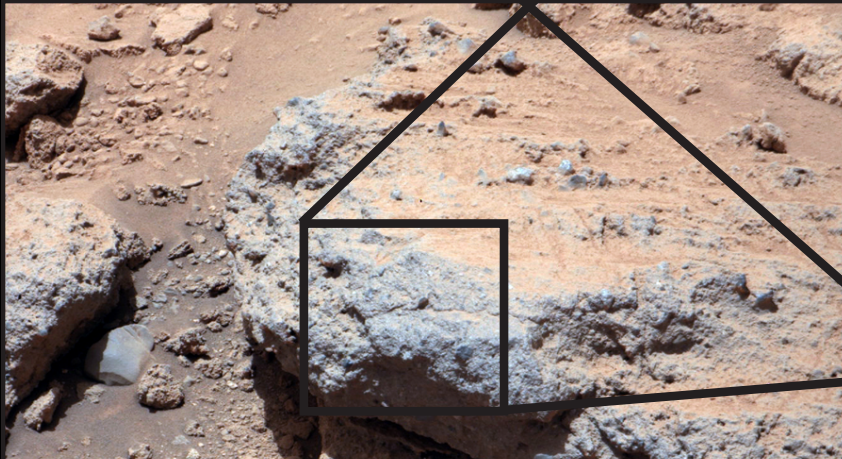
- Integral heater to warm mechanism for operation if needed.
- Can operate -40°C to $+60^{\circ}\text{C}$ and qualified to survive $>$ two Earth years of diurnal temperature cycles (down to -135°C) without heating.



Performance and use



Mastcam Left (34 mm) image of the Bardin Bluffs outcrop from ~ 5 m distance; Pixel Scale ~ 1.1 mm/pixel.



MAHLI image of the Bardin Bluffs outcrop from ~ 25 cm distance; simulates Hawkeye best resolution; Pixel Scale ~ 0.1 mm/pixel.



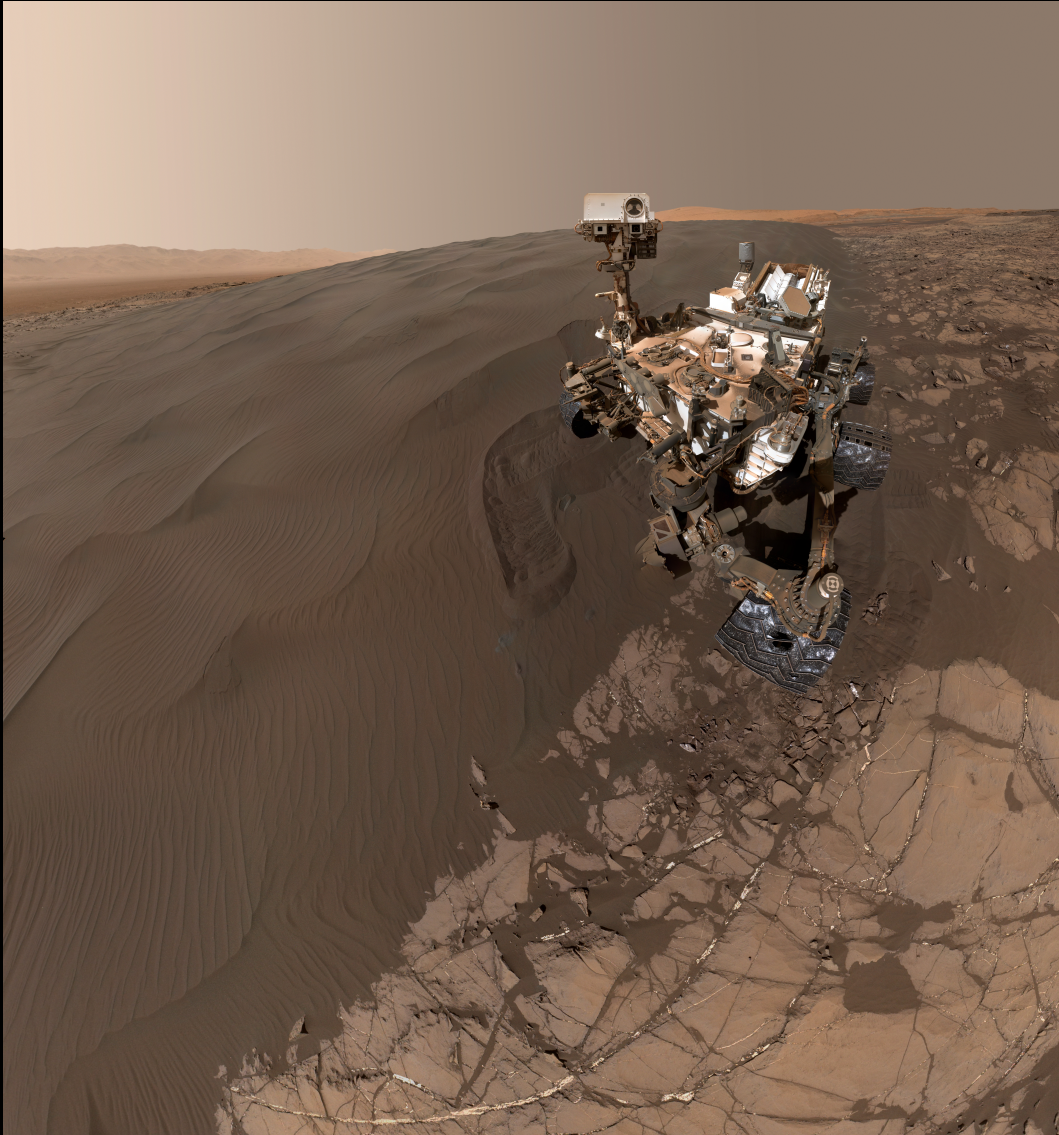
Performance and use

Simulated Hawkeye view:
Image at infinity focus
Closest objects are m away; distant feature
is km away



MSL MAHLI image 1072MH0003250050400731E01

Performance and use

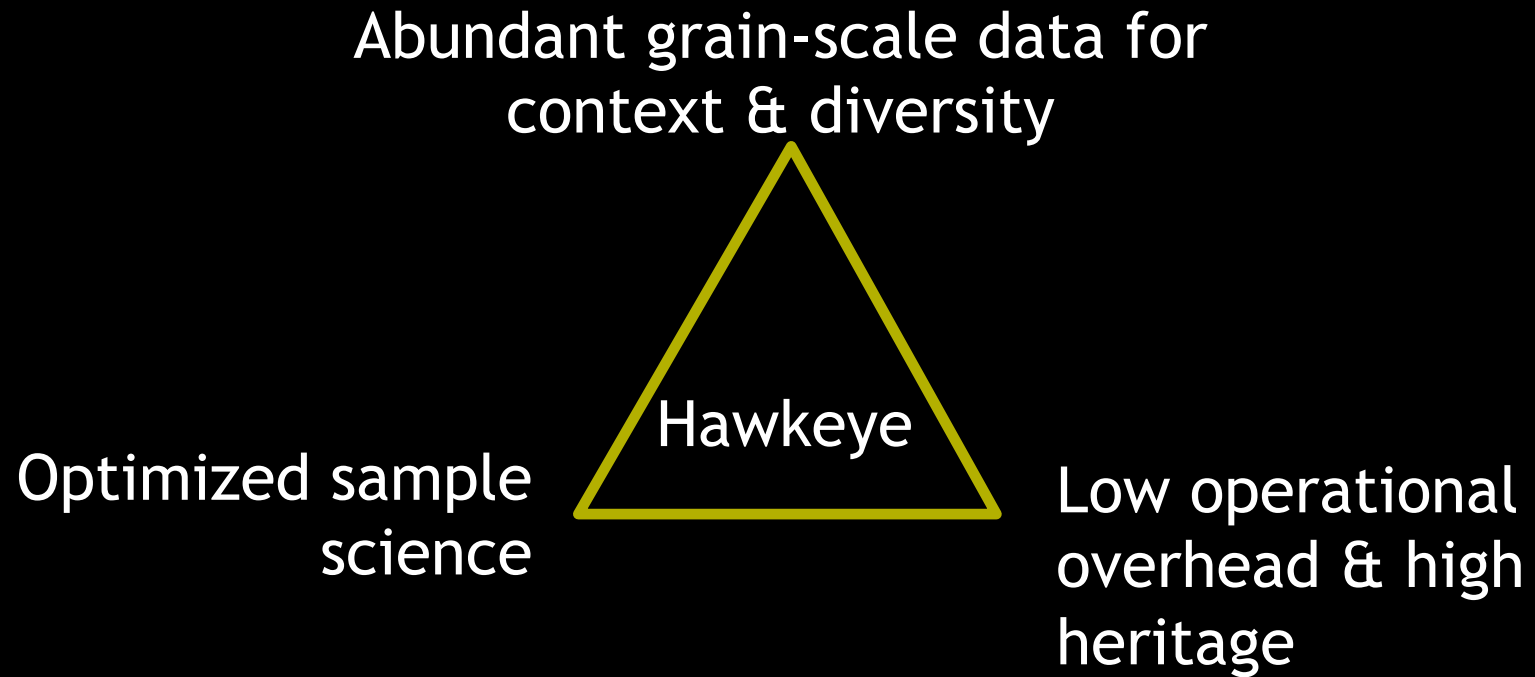


Simulated Hawkeye
panorama:
Mosaic of 65 images
acquired at infinity focus

Summary

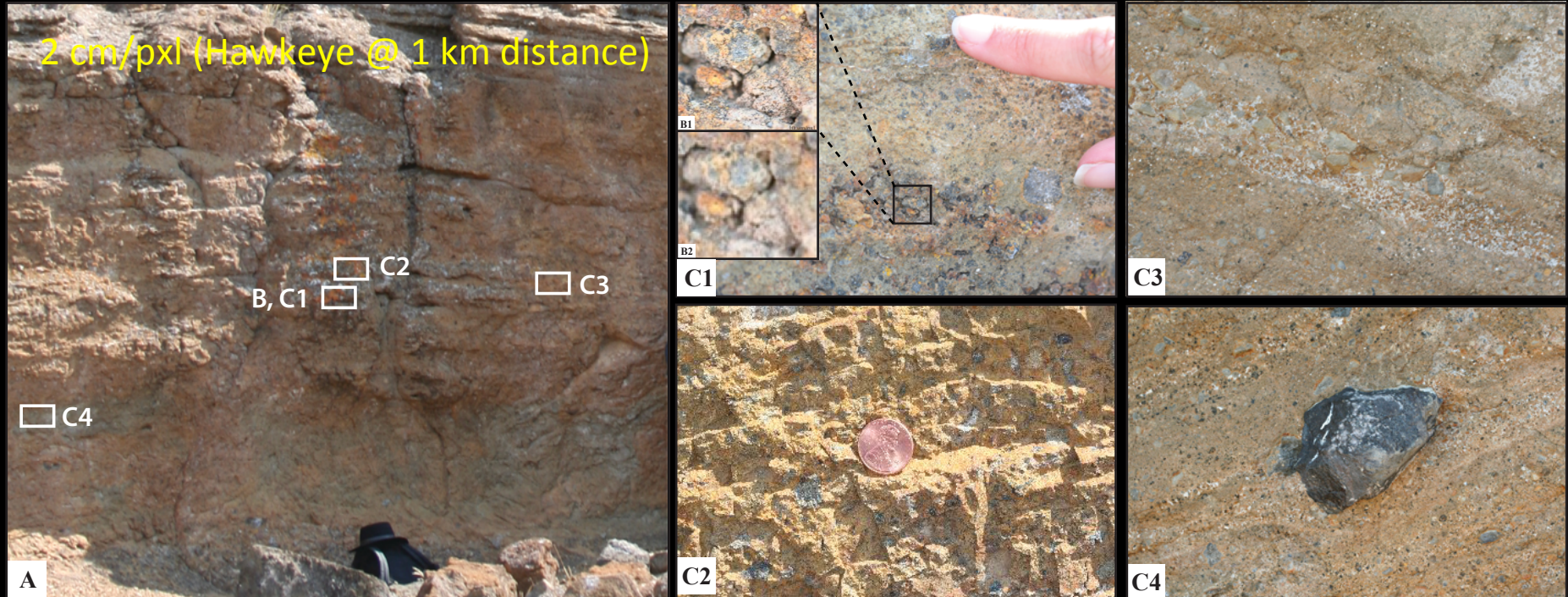
- The Hawkeye camera can decipher grain-scale textural clues to geologic or biologic history, from a distance.
- Wide field of view and focus to infinity enable panoramic imaging to place grain-scale observations in regional and local context.
- The broad range of distances over which Hawkeye yields useful images makes it a very cost-effective all-in-one imager that supports science and operations efficiency.

Summary



Backup slides

How Hawkeye meets the need



- Habitability potential? Not at the grain-scale.
- Images could be acquired in 6-8 minutes.